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Stokoe et al.

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(54) **MODULAR BOARD TO BOARD CONNECTOR**

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(51) **Int. Cl.**
H01R 13/502 (2006.01)

(52) **U.S. Cl.** **439/701**

(58) **Field of Classification Search** 439/701, 439/608, 378

See application file for complete search history.

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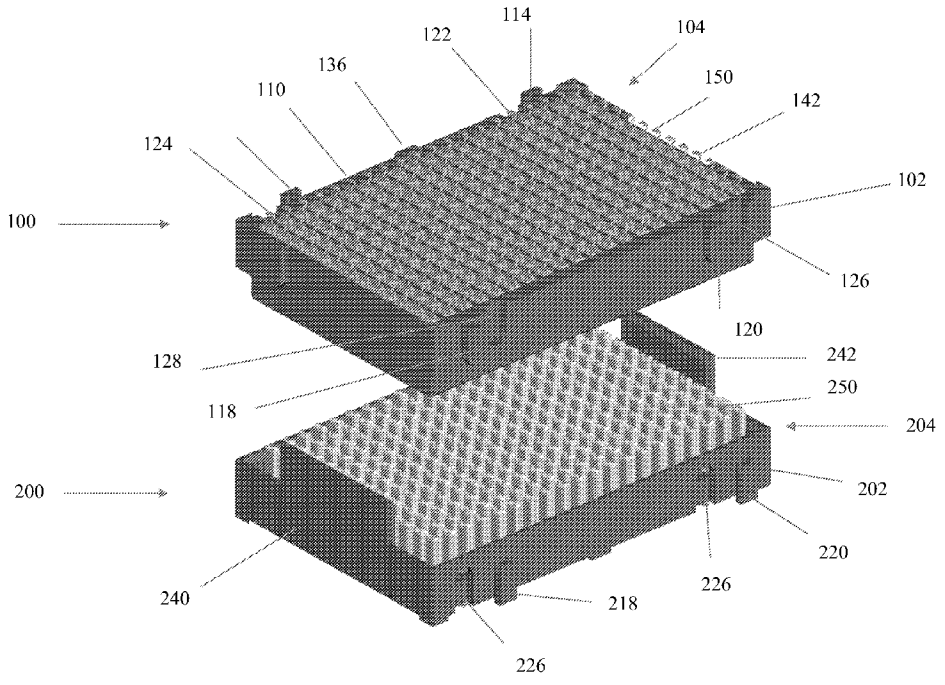
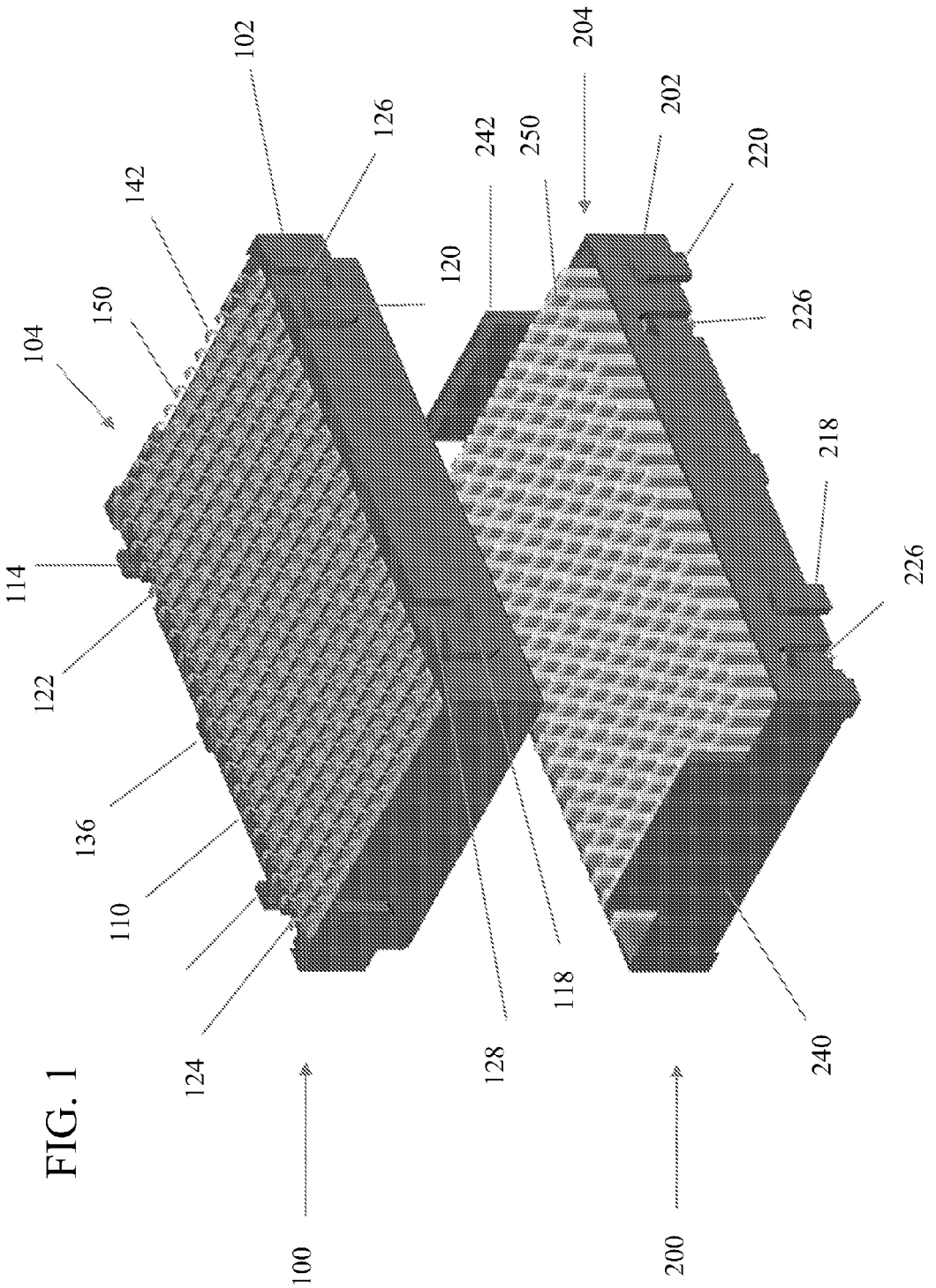
(57) **ABSTRACT**

A connector assembly has a receptacle module and a pin module that interconnect. Stiffener engagement projections and recesses are provided along the sides of the receptacle and pin modules in an alternating fashion. The recesses are sized and shaped to receive the stiffener engagement projections of a respective neighboring module. Stainless steel elongated stiffener plates removably engage the pin and receptacle modules in both an X-direction and/or a Y-direction. The stiffener plates have slots that extend partly through the plates and align with the stiffener engagement projections and receiving recesses. The slots receive respective ones of the projections of the neighboring pin and receptacle modules.

28 Claims, 13 Drawing Sheets

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204
126
242
250
202
142
220
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104
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122
136
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118
240
100
200

FIG. 1

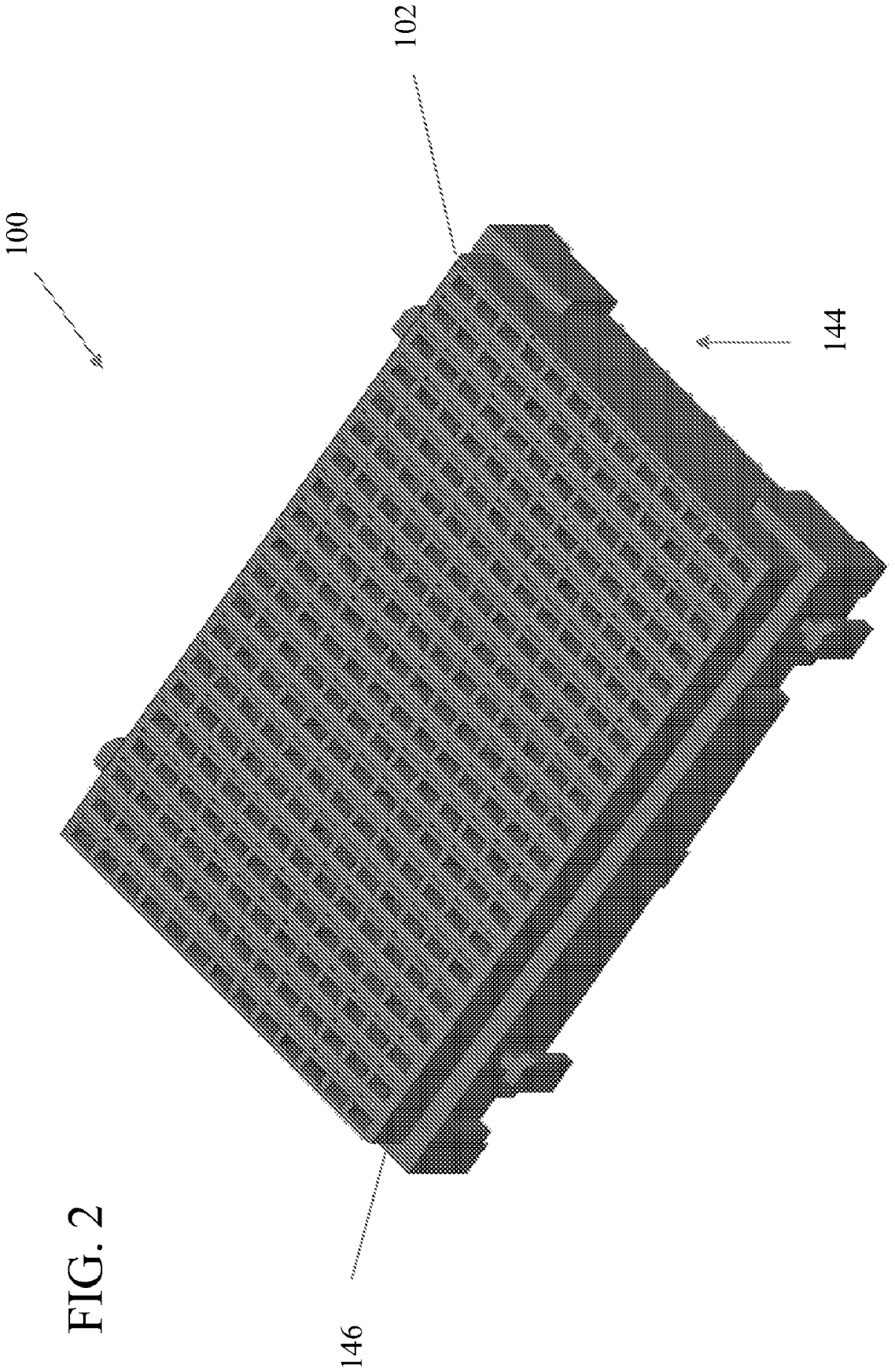

FIG. 2

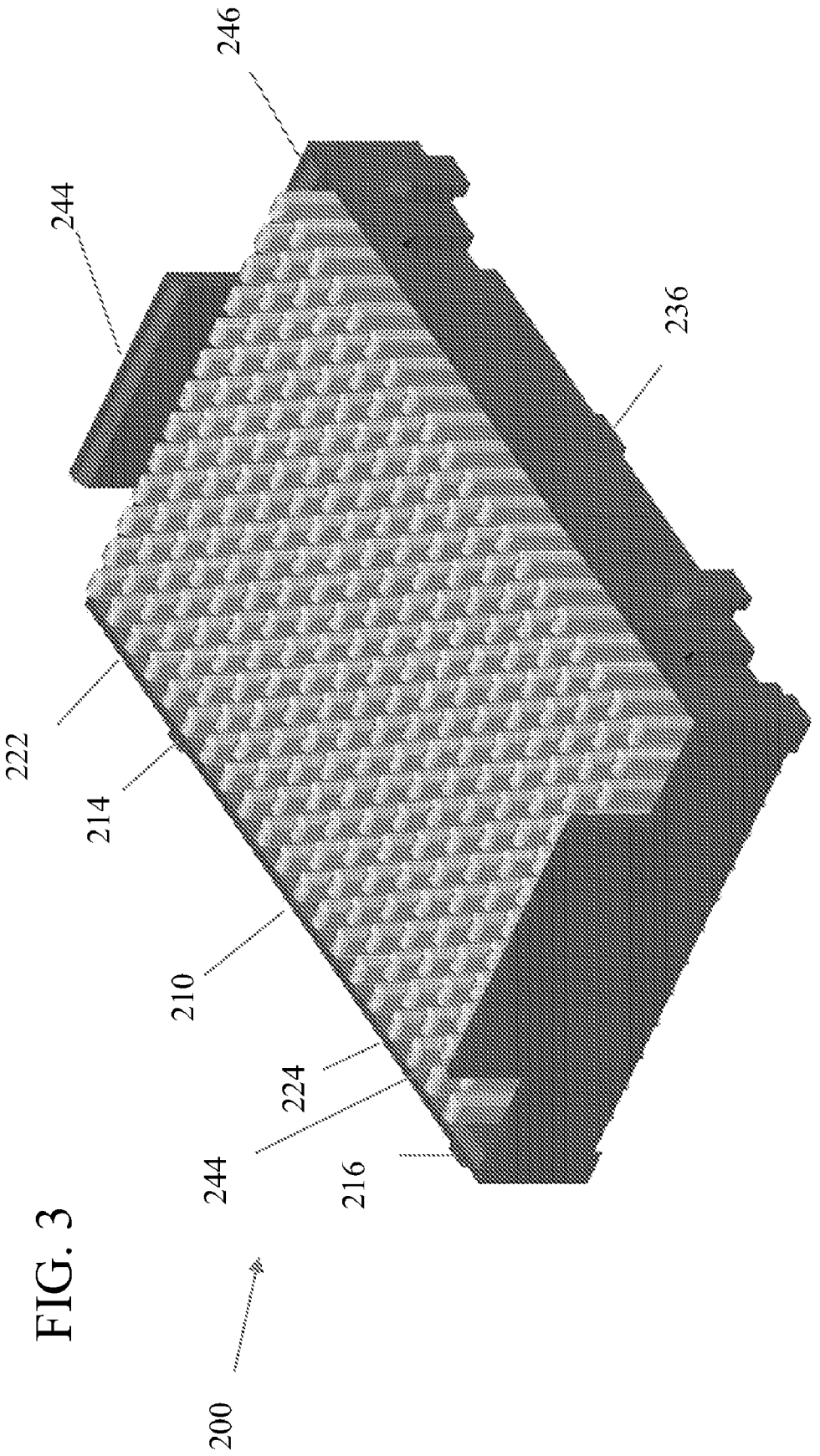

FIG. 3

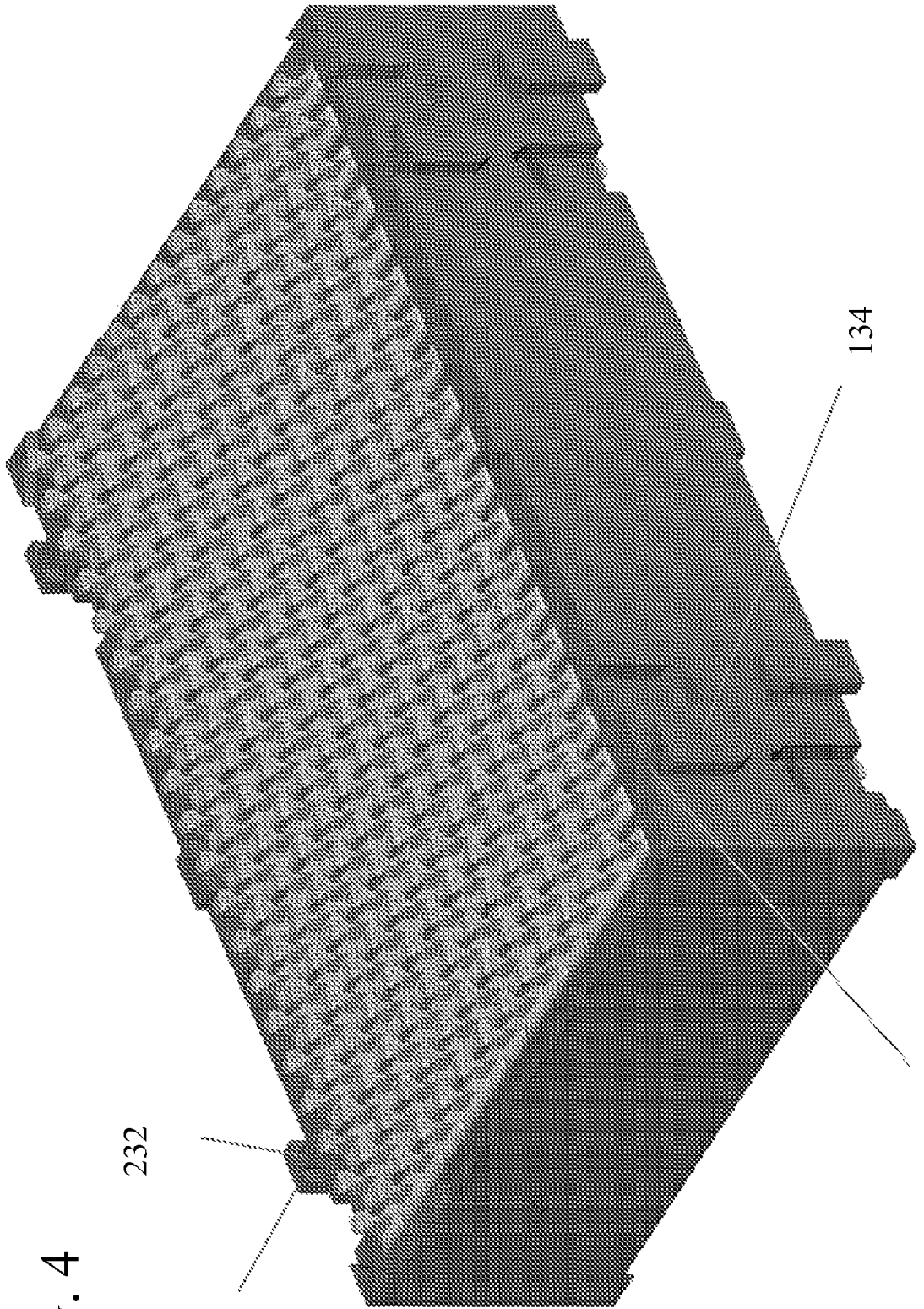

FIG. 4

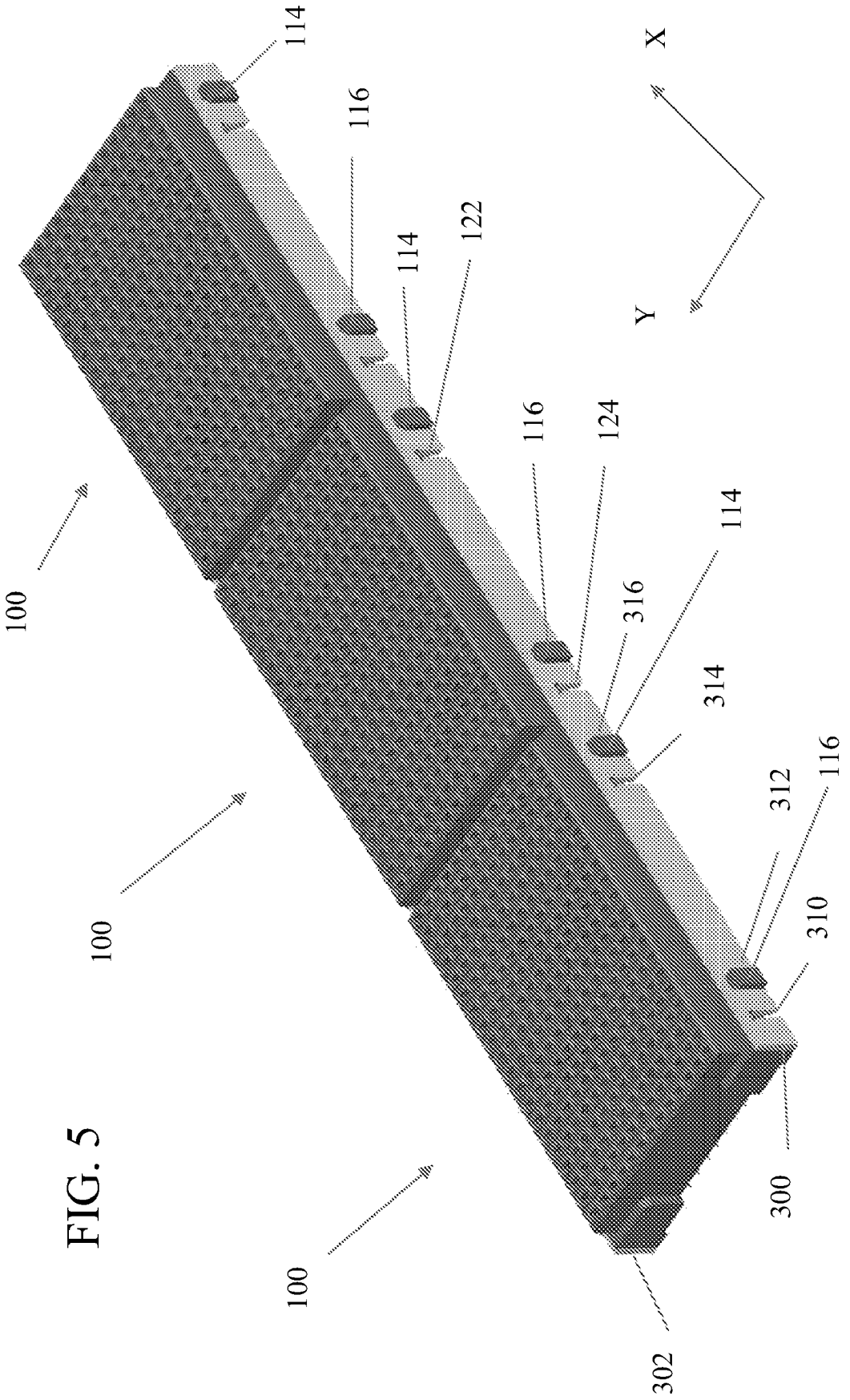
114
116
114
122
116
124
114
316
314
312
116
310
300
302
100
100
100
X
Y

FIG. 5

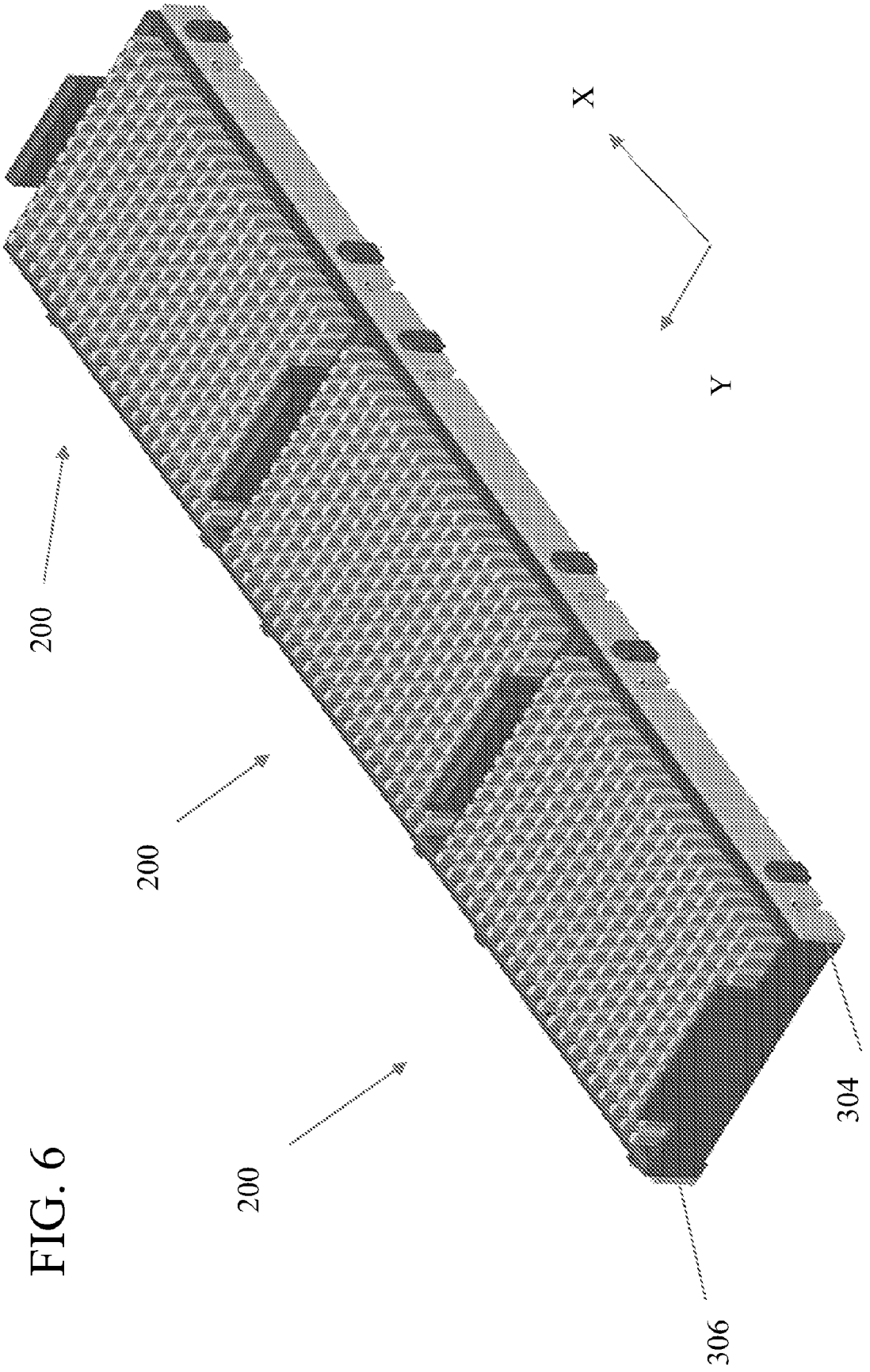

FIG. 6

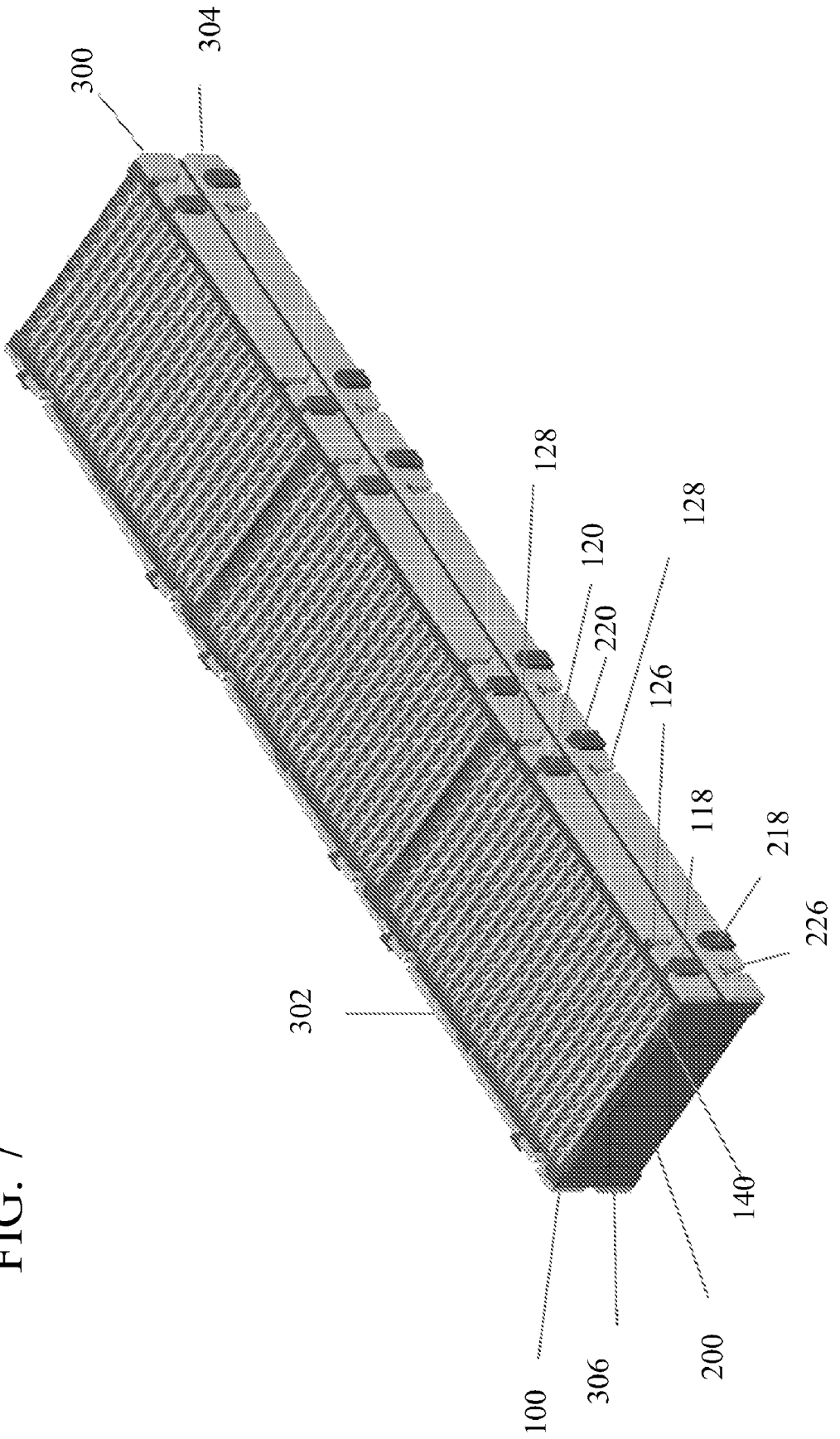

FIG. 7

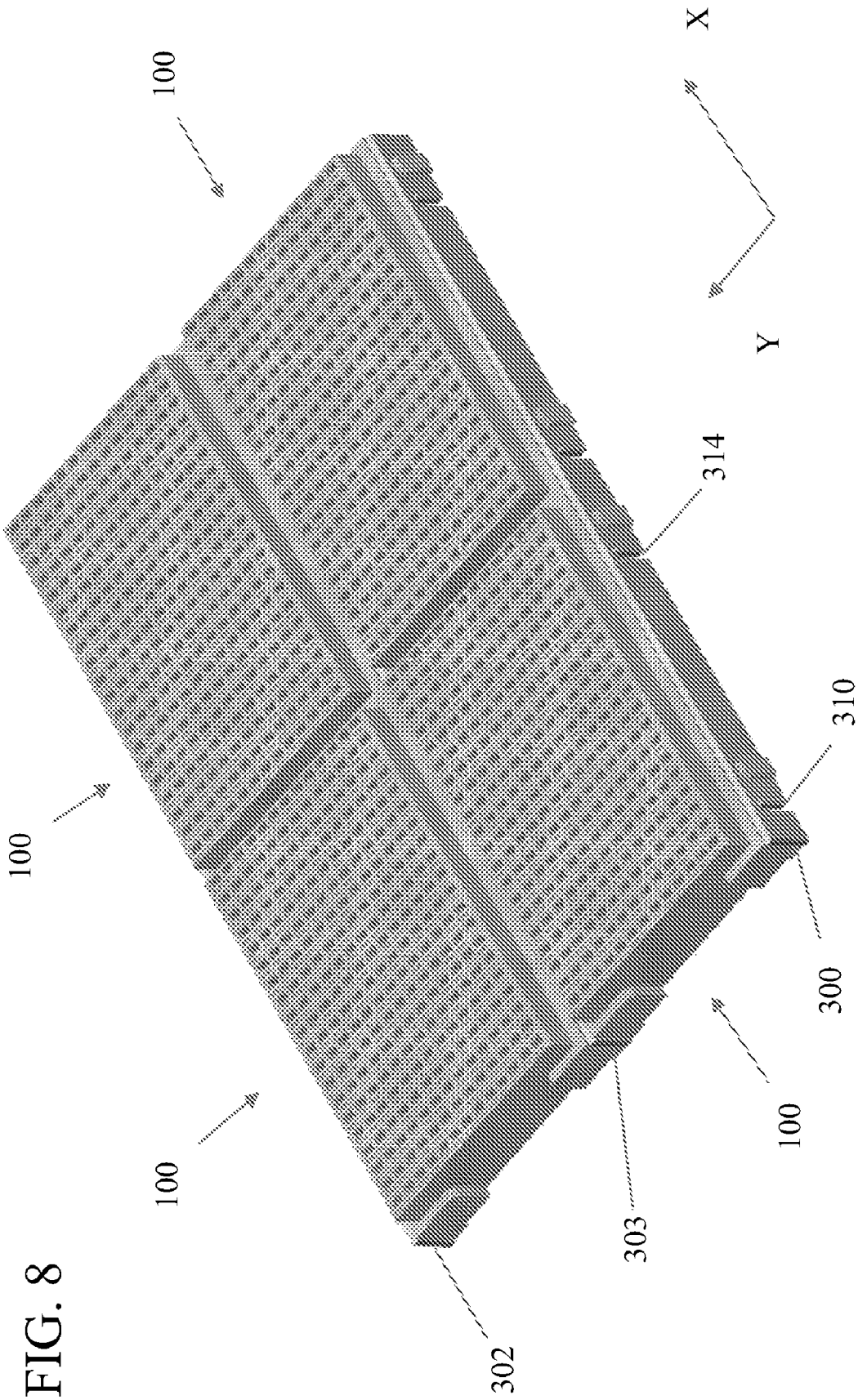

FIG. 8

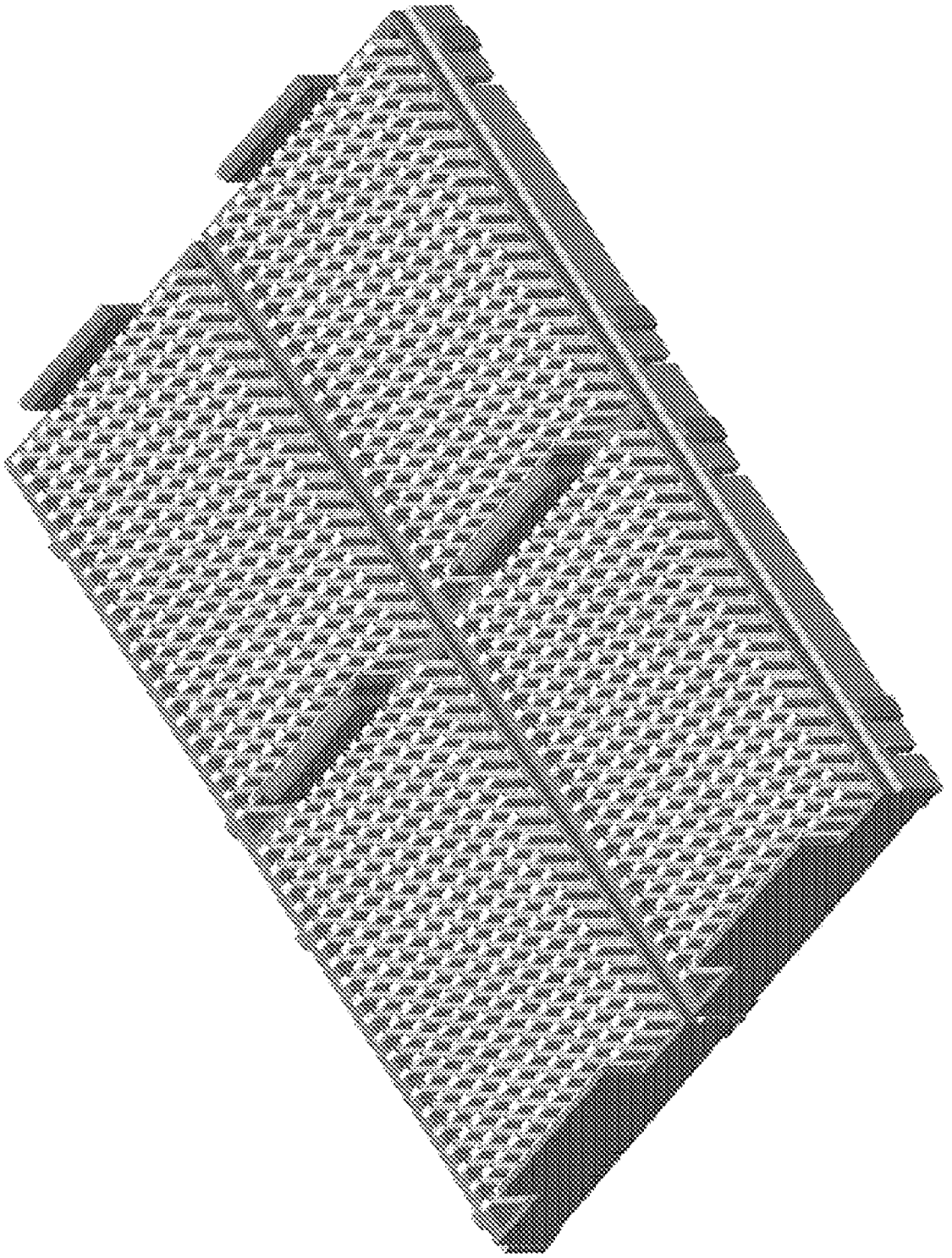

FIG. 9

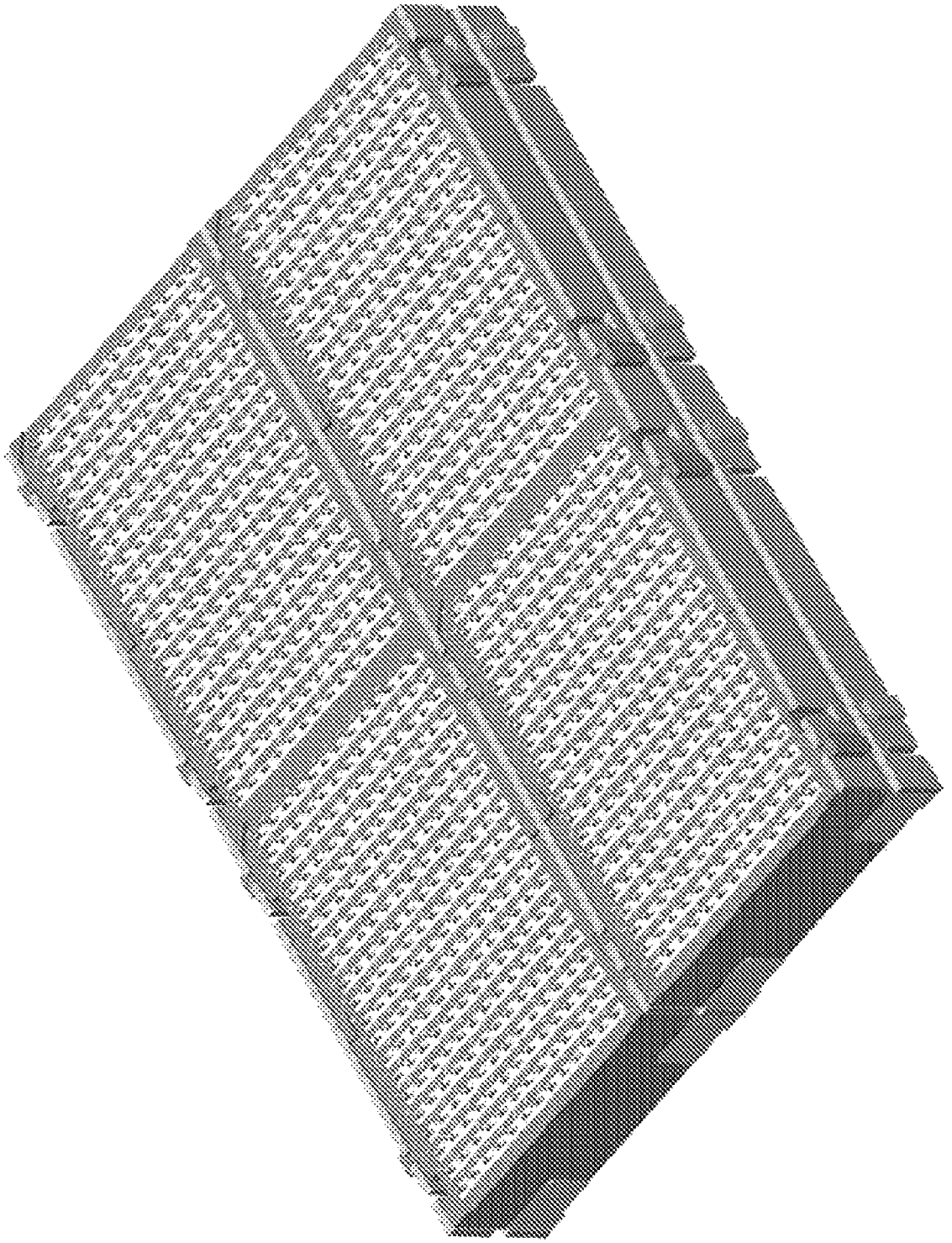

FIG. 10

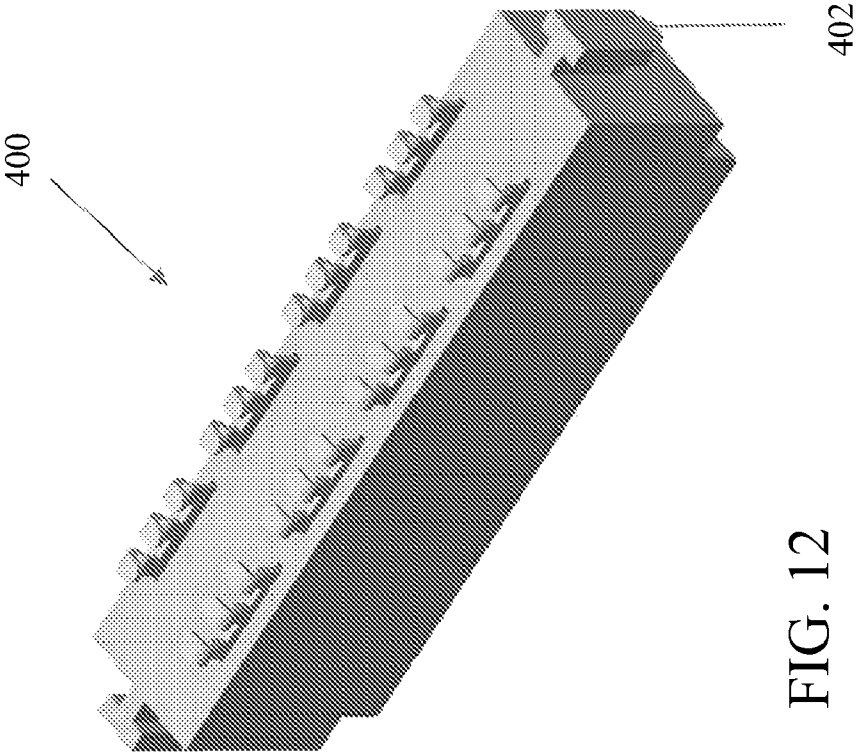

FIG. 12

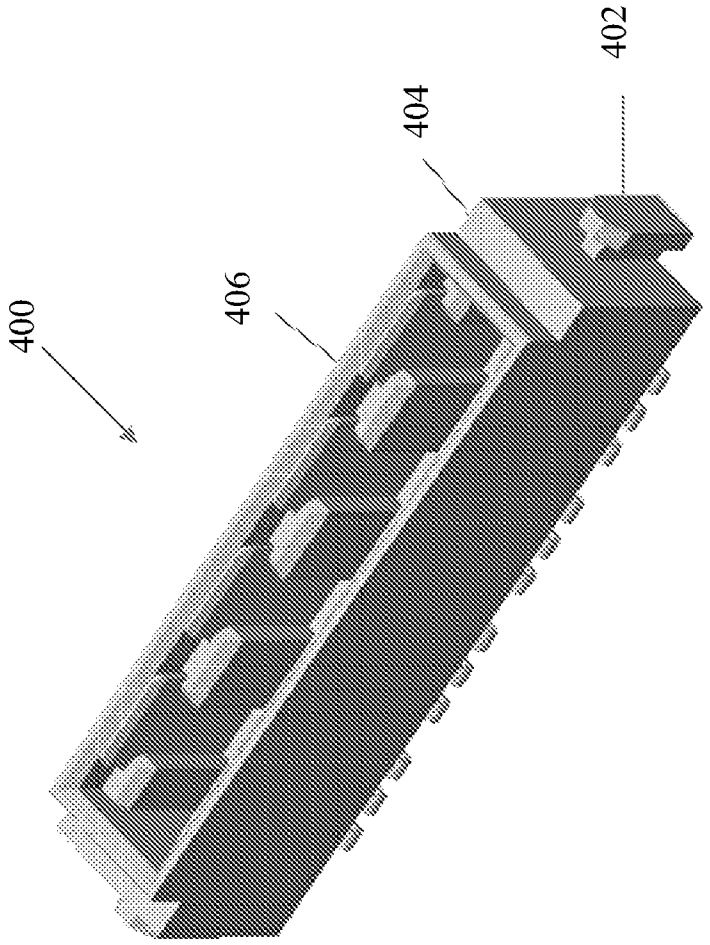

FIG. 11

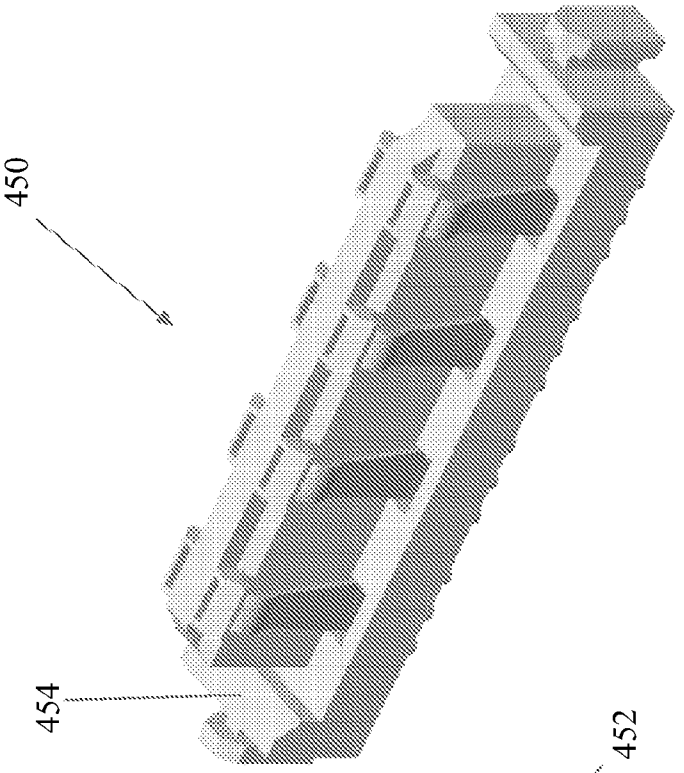

FIG. 14

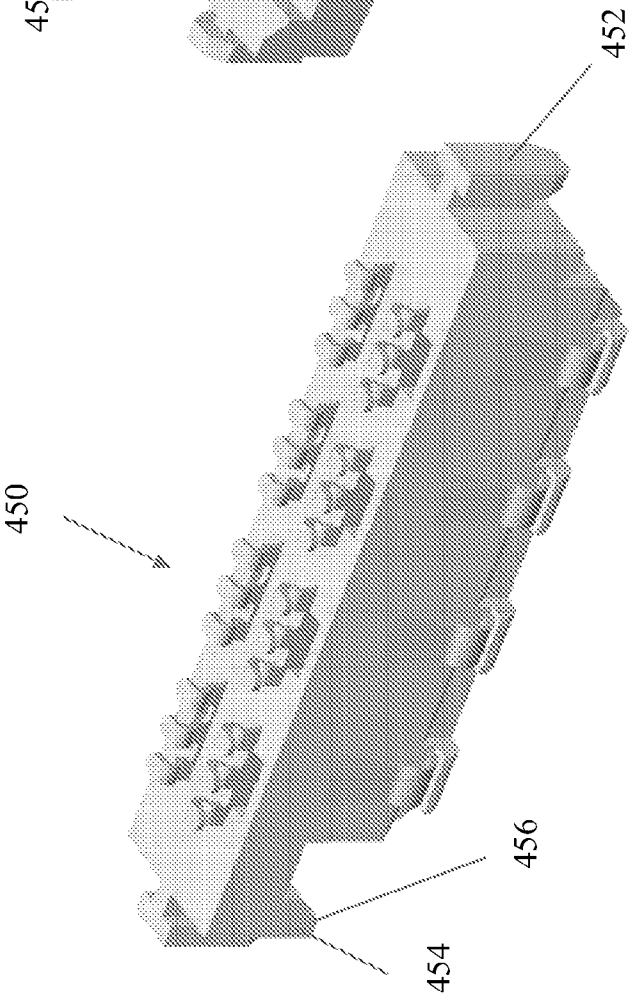

FIG. 13

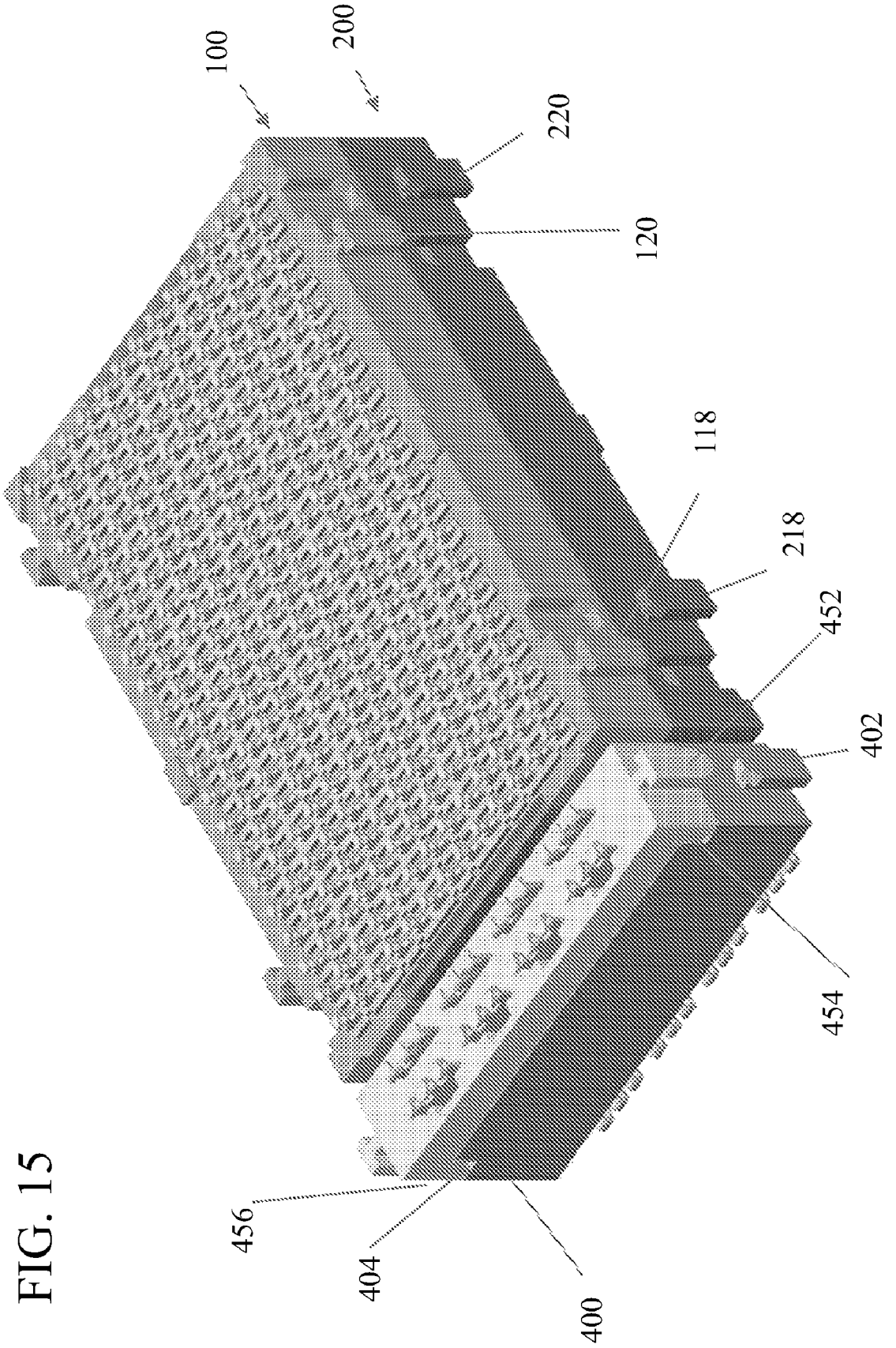

FIG. 15

MODULAR BOARD TO BOARD CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to board to board modular connectors. More particularly, the present modular connector invention permits the modular assembly of boards.

2. Background of the Related Art

Electrical connectors are used in many types of electronic systems. For example, in many computerized systems, printed circuit boards are joined together through connectors. One piece of the connector is attached to each board. The connector pieces are mated to complete many signal paths between the boards. In addition, the DC power or ground paths are also completed through the connector. The DC paths allow the printed circuit boards to be powered and, if configured appropriately, shield adjacent signal contacts to improve the integrity of signals passing through the connector. It is generally easier and more cost effective to manufacture a system on several printed circuit boards that are then joined together with electrical connectors.

Each half of the connector contains conducting contacts held in an insulative housing. Each contact has a contact region, which makes electrical contact to a contact in the other half of the connector when the connectors are mated. In addition, each contact has a tail portion which extends from the housing and is attached to a printed circuit board. The tail could be either a solder tail, which is soldered to the printed circuit board, or a press-fit tail, which is held by friction in a hole in a printed circuit board. The contact body carries the signal from the contact region to the tail.

One common type of signal contact simply uses a pin as the contact region. Pin contacts generally mate with receptacle type contacts. The contact area of a receptacle type contact is formed from a pair of parallel-cantilevered beams. The cantilevered beams generate a spring force against the pin, ensuring a good electrical contact. Other types of contacts can also used, such as contacts shaped as plates, blades or forks.

Connector housings are often molded from plastic. Initially, connector housings were molded in one piece. However, it is difficult to maintain the necessary tolerances for large surface mount connectors subject to high temperature gradients such that building large connectors from individual modules is easier.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide a modular board to board connector with X and Y scalability. It is a further object of the invention to provide boards connected by a stiffener that provides scalability in both an X and Y directions.

In accordance with these and other objectives, a connector or connector assembly is provided. The connector assembly has a receptacle module and a pin module that interconnect. Stiffener engagement projections are provided along the sides of the receptacle and pin modules. Recesses are also provided along the sides of the receptacle and pin modules. The recesses are sized and shaped to receive the stiffener engagement projections of a respective neighboring module.

Stainless steel stiffener plates removably engage the pin and receptacle modules in both an X-direction and/or a Y-direction. The stiffener plates have rectangular-shaped slots that extend partly through the plates and align with the stiffener engagement projections and receiving recesses of the pin and receptacle modules. The slots receive respective ones of the projections on the sides of the neighboring pin and receptacle modules. In the X-direction, the stiffener plates extend the length of multiple modules to engage the projections of those modules.

In the Y-direction, the projections on one side of each module are offset from the projections on the opposite side of that module, so that the projections do not align with those of a neighboring module. Thus, the stiffener plate receives the projections of neighboring modules in an alternating fashion. Accordingly, the stiffeners are able to engage connectors and their respective boards in a modular fashion in both the X-direction and the Y-direction.

These and other objects of the invention, as well as many of the intended advantages thereof, will become more readily apparent when reference is made to the following description, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a perspective view of a connector assembly having a receptacle module and a pin module prior to connection in accordance with the preferred embodiment of the invention;

FIG. **2** is a perspective bottom view of the receptacle module;

FIG. **3** is perspective top view of the pin module;

FIG. **4** is a perspective view of the connector assembly with the receptacle module connected to the pin module;

FIG. **5** is a perspective bottom view of three receptacle modules in an in-line configuration;

FIG. **6** is a perspective top view of three pin modules in an in-line configuration;

FIG. **7** is a perspective top view of three pin modules connected to three receptacle modules in an in-line configuration;

FIG. **8** is a perspective bottom view of a quad configuration of receptacle modules;

FIG. **9** is a perspective top view of a quad configuration of the pin modules;

FIG. **10** is a perspective top view of a quad configuration of the receptacle modules connected to the pin modules;

FIG. **11** is a bottom view of a power module used with the pin module;

FIG. **12** is a top view of the power module of FIG. **11**;

FIG. **13** is a top view of a power module used with the receptacle module;

FIG. **14** is a bottom view of the power module of FIG. **13**; and,

FIG. **15** is a top perspective view of the receptacle module and pin module with their respective power modules.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In describing a preferred embodiment of the invention illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

Turning to the drawings, FIG. **1** shows a connector or connector assembly **10** in accordance with a preferred embodiment of the invention. The connector assembly **10** has a receptacle module **100** and a pin module **200** that interconnect. The receptacle module **100** has an insulated housing **102** that extends around the outer circumference of a contact

section **104**. The contact section **104** has receptacles fitted with contacts **150**, which are shown in the embodiment of FIG. **1** as hook-type contacts. The insulated housing **102** is preferably a plastic material and has a rectangular or square shape, though other suitable materials and shapes can be utilized. The housing **102** includes openings for receiving the contacts **150** of the contact section **104**.

The housing portion **102** has a first side **110** and a second side **112** opposite the first side. The housing **102** also has a first end **140** and a second end **142** opposite the first end **140**. An engagement structure comprising stiffener engagement projections **114**, **116** are provided along the first side **110** of the receptacle module **100**, and stiffener engagement projections **118**, **120** are provided along the second side **112** of the receptacle module **100**. Each side **110**, **112** of the housing **102** preferably has at least two stiffener engagement projections so that the module **100** connects to neighboring modules **100** toward each end **140**, **142** of the module **100**. However, only a single projection can be provided on each side, and more than two projections can also be used. In addition, it is possible for a projection to be utilized on only one side of the module **100**.

As best shown in FIG. **4**, the projections **114**, **116**, **118**, **120** each have a narrow base portion **132** that extends outward from the face of the side wall **110**, **112**. A wide head or top portion **134** is connected substantially perpendicular to the top of the base portion **132** to form a T-shaped cross-section. As depicted, the top portion **134** has one end that is flat and one end that is beveled along its sides.

Returning to FIG. **1**, the first side **110** of the receptacle module **100** is also provided with recesses **122**, **124**, and the second side **112** of the receptacle module **100** is provided with engagement structures comprising recesses **126**, **128**. The recesses **122**, **124**, **126**, **128** are sized and shaped to receive the stiffener engagement projections **114**, **116**, **118**, **120**. Thus, as best shown in FIG. **4**, the receiving recesses **122**, **124**, **126**, **128** are formed so a first end is straight and a second end has beveled sides. The beveled sides of the projections **114**, **116**, **118**, **120** facilitate the top portion **134** being received by a respective receiving recess **122**, **124**, **126**, **128** of a neighboring receptacle module **100**. The recesses **122**, **124**, **126**, **128** preferably extend about half way into the side walls **110**, **112**, though can extend less or more or all the way through the side walls. A stand off **136** is provided along the sides **110**, **112** of the receptacle module **100**. The receptacle module **100** receives a printed circuit board ("PCB" or just "board") on the side facing away from the pin module **200**. The stand off **136** controls the amount of stress the hook like leads may be subject too during the attachment process.

Referring to FIG. **2**, an opening **144** is located at each of the first and second ends **140**, **142** of the receptacle module **100**. The housing **102** also has a recessed portion **146** at the bottom of the receptacle module **100** that engages a respective configuration of the pin module **200**.

The pin module **200** has an insulated housing **202** that extends around the outer circumference of a contact section **204**. The contact section **204** has receptacles fitted with contacts **250**, which are shown in the embodiment of FIG. **1** as pin contacts. The insulated housing **202** is preferably a plastic material and has a rectangular or square shape, though other suitable materials and shapes can be utilized. The housing **202** includes openings for receiving the contacts **250** of the contact section **204**.

The housing portion **202** has a first side **210** and a second side **212** opposite the first side **210**. The housing **202** also has a first end **240** and a second end **242** opposite the first end **240**. Stiffener engagement projections **214**, **216** are provided along the first side **210** of the pin module **200**, and stiffener engagement projections **218**, **220** are provided along the second side **212** of the pin module **200**. Each side **210**, **212** of the housing **202** preferably has at least two stiffener engagement projections so that the module **200** connects to neighboring modules **200** toward each end **240**, **242** of the module **200**. However, only a single projection can be provided on each side, and more than two projections can also be used. In addition, it is possible for a projection to be utilized on only one side of the module **200**.

As best shown in FIG. **4**, the projections **214**, **216**, **218**, **220** each have a narrow base portion **232** that extends outward from the face of the side wall **210**, **212**. A wide head or top portion **234** is connected substantially perpendicular to the top of the base portion **232** to form a T-shaped cross-section. As depicted, the top portion **234** has one end that is flat and one end that is beveled along its sides.

Returning to FIG. **1**, the first side **210** of the pin module **200** is also provided with recesses **222**, **224**, and the second side **212** of the pin module **200** is provided with recesses **226**, **228**. The recesses **222**, **224**, **226**, **228** are sized and shaped to receive the stiffener engagement projections **214**, **216**, **218**, **220**. Thus, as best shown in FIG. **4**, the recesses **222**, **224**, **226**, **228** are formed so a first end is straight and a second end has beveled sides. The beveled sides of the projections **214**, **216**, **218**, **220** facilitate the top portion **234** being received by respective recesses **222**, **224**, **226**, **228** of a neighboring pin module **200**. The recesses **222**, **224**, **226**, **228** preferably extend about half way into the side walls **210**, **212**, though can extend less or more or all the way through the side walls. A stand off **236** is provided along the sides **210**, **212** of the pin module **200**. The pin module **200** receives a PCB on the side facing away from the receptacle module **100**, and the stand off **236** controls the stress the hook like leads may be subject to during the attachment process.

Referring to FIG. **3**, the first and second ends **240**, **242** of the pin module **200** have upright alignment tab portions **244**. The housing **202** also has a narrowed inner portion **246** at the top of the pin module **200** that engages the recessed portion **146** of the receptacle module **100**. The narrowed inner portion **246** has a beveled face.

As shown in FIG. **4**, the receptacle module **100** mates with the pin module **200** such that the contacts **250** of the pin module **200** electrically engage the contacts **150** of the receptacle module **100**. The tab portions **244** of the pin module **200** are slidably received in the opening **144** of the receptacle module **100**. The tab portion **244** and opening **144** pre-align the pin module **200** with the receptacle module **100** to initially align the respective contacts **150**, **250**. The top of the tabs **244** are tapered, so that if the bottom of the receptacle module **100** come into contact with them, they move inward to better align with the pin module **200**. The tab portions **244** and openings **144** are offset on the end walls **140**, **142** and **240**, **242** to ensure that the receptacle module **100** and the pin module **200** are properly aligned in the correct direction and position.

As the receptacle module **100** and pin module **200** come closer and the housings **102**, **202** contact one another, the narrowed inner portion **246** of the pin module **200** receives the recessed portion **146** of the receptacle module **100**, as also shown in FIGS. **17**(*a*) and (*b*). The beveled face of the inner portion **246** facilitates alignment of the respective contacts **150**, **250** of the modules **100**, **200**. The narrowed inner portion **246** and recessed portion **146**, as well as the contacts **150**, **250**, form a snug friction fit between the modules **100**, **200**. The portions **246**, **146** also form the final alignment of the

receptacle module **100** and pin module **200** and align the bottoms of the receptacle contacts **150** with the tops of the pin contacts **250**.

Further to the preferred embodiment, the receptacle module **100** and the pin module **200** each have a length of about 27.3 mm and a width of about 18.4 mm. And, there are 20 rows and 13 columns of contacts **150**, **250**. However, the dimensions and number of contacts are not intended to limit the invention. The modules **100**, **200** can have any suitable dimensions and number of rows and columns, either greater or less than the preferred embodiment, while still falling within the scope of the invention.

In FIG. **5**, the modularity of the system **10** is shown in the X-direction. Three receptacle modules **100** are illustrated having an in-line configuration. Stainless steel elongated stiffener plates **300**, **302** removably engage the modules **100**. Though three modules **100** are shown in the embodiment of FIG. **5** connected by two stiffeners **300**, **302**, two or more modules **100** can be connected by the stiffeners **300**, **302** as suitable for a particular application. In addition, though in the preferred embodiment the stiffeners **300**, **302** extend the entire length of the three modules **100**, more than one stiffener **300**, **302** can be provided along each side of the modules **100**. Thus, for instance, two stiffeners (each about one-half the length of the stiffener **300**) can replace the single stiffener **300**. Or, two shortened stiffeners can be used, one that connects the projection **118** of the first (nearest in the embodiment of FIG. **5**) module **100** with the projection **120** of the second (middle) module **100**; and a second one that connects the projection **118** of the second module **100** with the projection **120** of the third (rear) module **100**.

In the embodiment shown, the modules **100** are connected in a single in-line configuration to have X-direction scalability. The stiffener plates **300**, **302** have rectangular-shaped slots **310**, **312**, **314**, **316** that extend partly through the plates **300**, **302** and align with the stiffener engagement projections and receiving recesses of the modules **100**, **200**. The slots **312**, **316** receive respective ones of the projections **114**, **116** on the first side **110** of the modules **100**. The slots **310-316** are slightly wider than the thickness of the base portions **132**, **232** but narrower than the width of the top portions **134**, **234** of the projections **114**, **116**. Accordingly, the base portions **132** of the projections **114**, **116** are slidably received in a respective slot **316**, **312** of the stiffener **300**. The stiffener **302** is likewise removably connected to the projections **118**, **120** on the second side **112** of the receptacle module **100**. Since the slots of the stiffener are narrower than the top portions **134**, the projections cannot pull free from the stiffener if the stiffener is pulled in a direction away from the module **100**.

In FIG. **6**, the pin modules **200** are also shown in an in-line configuration. Stiffeners **304**, **306** connect the modules **200** together. The stiffeners **300**, **302**, **304**, **306** are all made of stainless steel, having a similar coefficient of expansion as a typical printed circuit boards ("PCB") that connect to the modules **100**, **200**. In this way, the stiffeners **300**, **302**, **304**, **306** expand and contracts significantly the same as the PCB to maintain the system **10** alignment integrity under various thermal conditions providing precise surface mount contact lead to PCB pad alignment. The metal stiffeners can be made with greater accuracy than a similar sized housing can be molded.

Because the modules **100**, **200** are made from plastic and the PCB materials have a different coefficient of expansion than the modules **100**, **200**, the modules **100**, **200** and the PCBs would create an unacceptable SMT lead alignment, especially as the connector/modules become larger in size. The stiffeners **300-306** have substantially similar coefficients of expansion as the PCB. Thus, the modules **100**, **200** are sized to minimize the thermal expansion in the X and Y axis and are assembled to stiffeners **300**, **302**, **304**, **306**. The expansion of the connector under various thermal conditions are controlled by stiffeners **300**, **302**, **304**, **306** in the X axis. When multiple modules **100**, **200** are assembled with stiffeners **300**, **302**, **303**, **304**, **306** in the Y axis (FIG. **8**), the stiffener engagement projection **114**, **116**, **118**, **120** and recesses **122**, **124**, **126**, **128** accommodate expansion and contractions under any thermal conditions.

FIG. **7** shows the modules **100**, **200** in an in-line configuration, with the receptacle modules **100** connected to the pin modules **200**. As shown, the projections **118**, **120** and the recesses **128**, **126** of the receptacle modules **100** are in reverse positions than the projections **218**, **220** and the recesses **228**, **226** of the pin modules **200**, respectively. Thus, for instance, while the receptacle module **100** has a projection **126** located closes to the first end **140**, the pin module **200** has a recess **226** located closest to the first end **240**. Accordingly, the projections **118**, **120** on the second side **112** of the module **100** will align and mate with the mating recesses **122**, **124** on the first side **110** of a neighboring module **100** in the Y-direction. And, the projections **114**, **116** on the first side **110** of a module **100** will align and mate with the mating recesses **126**, **128** on the second side **112** of a neighboring module **100** in the Y-direction.

In addition, the stiffeners **300**, **302** of the receptacle modules **100** are inverted with respect to the stiffeners **304**, **306** of the pin modules **200**. Thus, the slots **310**, **312**, **314**, **316** of all the stiffeners **300**, **302**, **304**, **306** face outward, i.e., in the embodiments shown, the slots on the top open upwardly and the slots on the bottom open downwardly. In that manner, the stiffeners **300**, **302**, **304**, **306** cannot be removed from the modules **100**, **200** while the receptacle modules **100** are connected to the pin modules **200**. Yet, the individual modules **100**, **200** can be separately added to or removed from the stiffeners and repaired or replaced, if necessary.

It should be appreciated, however, that the stiffeners, engagement projections and their receiving recesses could be readily configured so that the individual modules **100**, **200** cannot be removed unless the entire stiffener connecting all the modules is removed. It should further be noted that the stiffeners **300**, **302** are identical to each other. Namely, the slots in each of the stiffeners **300**, **302** are at the same position along the stiffeners. Thus, the stiffeners are interchangeable with one another, which reduces cost of manufacturing and ease of use.

In FIG. **8**, four receptacle modules **100** are connected in a 2×2 quad configuration to illustrate the X and Y scalability of the invention. Three stiffeners **300**, **302** are provided to connect the modules **100**. Because the projections **118**, **120** and recesses **126**, **128** along the first side **110** of the modules **100** are reversed with respect to the projections **114**, **116** and recesses **122**, **124** along the second side **112** of the modules **100**, a single stiffener **303** is utilized to connect the modules **100** to one another in the Y-direction (best shown in FIG. **10**). Additional modules **100** can be connected to the unused slots **310**, **314** of the stiffeners **300**, **302** to further expand the configuration in the Y-direction. The figure further illustrates the use of the stiffeners **300**, **302**, **303** connecting two modules **100** in the X-direction. It should be appreciated that any number of modules can be connected together to form arrays of different dimensions as suitable for a particular application, within the scope of the present invention. The invention is most useful, however, in the preferred embodiment where there are at least two modules in each of the X and Y directions, i.e., the quad configuration shown.

FIG. **9** illustrates four pin modules **200** connected in a 2×2 quad configuration and FIG. **10** illustrates the quad receptacle modules **100** of FIG. **8** connected to the quad pin modules **200** of FIG. **9**. FIG. **10** shows the projections of the receptacle modules **100** engaged in the mating recesses of the neighboring receptacle modules **100** in the Y-direction.

The invention can also be used to connect modules having smaller dimensions than the receptacle and pin modules **100**, **200** of FIGS. **1-10**, or to connect modules of different sizes and shapes. For instance, the invention can be utilized with the modules **400**, **450** shown in FIGS. **11-14**. In addition, the modules **400**, **450** are power modules that are especially useful to connect with the receptacle and pin modules **100**, **200** because the power modules **400**, **450** provide the power necessary to drive and operate the receptacle and pin modules **100**, **200**.

FIGS. **11-14** show that the power modules **400**, **450** each have a projection **402**, **452** along each of two opposing sides. The power module **400** (FIGS. **11-12**) is utilized to provide power to one or more pin modules **200**, and the power module **450** (FIGS. **13-14**) provides power to one or more receptacle modules **100**. The top of the pin power module **400** has a ledge **404** forming a tab **406**. The bottom of the receptacle power module **450** has a downwardly extending sidewall **454** having a beveled inward face **456**.

In FIG. **15**, the receptacle power module **450** is connected to the pin power module **400**. The ledge **404** of the pin power module **400** receives the downward extending sidewall **454** of the receptacle power module **450**. Thus, the tab **406** of the pin power module **400** is received within the sidewall **454** of the receptacle power module **450**. The beveled face **456** facilitates connection by pre-aligning the power modules **400**, **450** with each other prior to connection.

As illustrated in the embodiment shown, the combined power modules **400**, **450** are positioned adjacent to the modules **100**, **200** so that the power module projections **402**, **452** are aligned with the projections **118**, **218** of the modules **100**, **200**. A stiffener (not shown) can then be connected to the power modules **400**, **450** and to the receptacle and pin modules **100**, **200**. The power modules **400**, **450** can connect to one of the standard slots located in the stiffener. Or, an additional slot(s) can be provided in the stiffener to accommodate one or more modules that may have different spacing requirements for the slots, such as the power modules **400**, **450** of the present embodiment. One or more sets of power modules **400**, **450** may be provided for one or more receptacle and pin modules **100**, **200**. For instance, the quad configurations of FIGS. **8-10** can be provided with up to 4 sets of power modules **400**, **450**, i.e., one for each receptacle and pin module **100**, **200**.

As has been shown, the invention provides X and Y scalability for flexibility in expanding module connections, replacing or repairing damaged modules, and is configurable to meet signal density needs. The stiffeners also reduces coefficient of expansion mismatch between PCBs and pin and receptacle modules. This is especially important during reflow where the heating and cooling at different rates than solder creates stress due to the mismatch in the coefficient of expansion. Additionally the design of hook like lead having a level of compliancy further reduces the stress transferred to the solder joint. Though the invention is illustrated in the figures with single ended contacts, it can also be utilized for differential contacts.

Further to the preferred embodiment, the modules **100**, **200** are each approximately 24 mm long by about 15 mm wide, and the stiffeners **300-306** are each about 44 mm long, 2 mm wide, and about 0.5 mm thick. However, any suitable size and shape modules and stiffeners can be utilized without departing from the spirit and scope of the invention.

The foregoing description and drawings should be considered as illustrative only of the principles of the invention. Numerous applications of the invention will readily occur to those skilled in the art. Therefore, it is not desired to limit the invention to the specific examples disclosed or the exact construction and operation shown and described. Rather, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

We claim:

1. A connector assembly comprising:

a first module having a first side with an engagement structure, a second side, and a first contact section;

a second module having a second contact section and a first side with an engagement structure, wherein the first side of said second module is aligned with the first side of said first module along a first plane;

a third module having a third contact section, a first side with an engagement structure and a second side, wherein the second side of said third module is aligned with the second side of said first module along a second plane, and wherein the first, second and third contact sections are coplanar; and,

an elongated plate having a first engagement structure removably engaging the engagement structure of said first module, a second engagement structure removably engaging the engagement structure of said second module, and a third engagement structure removably engaging the engagement structure of said third module.

2. The connector assembly of claim **1**, further comprising a fourth module having a first side with an engagement structure and a second side, and said second module having a second side, wherein the first side of said fourth module is aligned with the second side of said second module along the second plane and the second side of said fourth module is aligned with the first side of said third module, said elongated plate further having a fourth engagement structure removably engaging the engagement structure of said fourth module.

3. The connector assembly of claim **1**, wherein the first plane comprises substantially horizontally and said second plane comprises substantially vertically.

4. The connector assembly of claim **1**, wherein the first plane is substantially perpendicular to the second plane.

5. The connector assembly of claim **1**, wherein the first side of each of the first, second, and third modules is substantially perpendicular to the second side of each of the first, second and third modules, respectively.

6. The connector assembly of claim **1**, wherein the first, second and third modules each have a body formed of an insulative material.

7. The connector assembly of claim **1**, wherein the first, second and third modules each have a top surface, and the first, second and third contact sections are respectively formed at the top surface of the first, second and third modules, and said first, second and third contact sections receive a printed circuit board.

8. The connector assembly of claim **1**, wherein said engagement structures of said first, second and third modules each comprise a projection and said first, second and third engagement structures of said elongated plate each comprise a slot.

9. The connector assembly of claim **1**, wherein each of said first, second and third modules are substantially rectangular or square in shape.

10. The connector of claim **1**, wherein the first, second and third contact sections receive electrical contacts.

11. A connector assembly comprising:

a plurality of modules each having a top surface, a first side and a second side substantially opposite the first side and at least one engagement structure at one of the first and second sides, wherein said plurality of modules are aligned such that the top surfaces of the plurality of modules are coplanar with one another and said plurality of modules form at least one row and at least one column; and,

an elongated plate having a plurality of engagement structures removably engaging the at least one engagement structure of the modules in the at least one row and the modules in the at least one column.

12. The connector assembly of claim 11, wherein said plurality of modules comprises a first module, a second module, a third module and a fourth module, and said at least one row comprises a first row having the first and second modules and a second row comprising the third and fourth modules and said at least one column comprises a first column having the first and third modules and a second column having the second and fourth modules.

13. The connector assembly of claim 11, wherein said at least one row is substantially perpendicular to said at least one column.

14. The connector assembly of claim 11, wherein said at least one engagement structure of said plurality of modules comprises a projection and said plurality of engagement structures of said elongated plate comprises a slot.

15. The connector assembly of claim 11, wherein each of said plurality of modules are substantially rectangular or square in shape.

16. The connector of claim 11, wherein the first, second and third contact sections are at a top of the first, second and third modules, respectively.

17. The connector assembly of claim 11, further comprising a plurality of rows and a plurality of columns.

18. An engagement device for engaging a plurality of modules each having a top surface, a first side and a second side substantially opposite the first side and at least one engagement structure at one of the first and second sides, the plurality of modules being aligned to form at least one row and at least one column, said engagement device comprising:

an elongated plate;

a plurality of engagement structures removably engaging the at least one engagement structure of the modules in the at least one row and the modules in the at least one column so that the top surfaces of the plurality of modules are coplanar with one another.

19. A method comprising:

providing a first module having a top surface, at least one side and an engagement structure at the at least one side, the first module having a central horizontal axis and a central vertical axis;

providing a second module having a central horizontal axis aligned substantially with the central horizontal axis of said first module, said second module having a top surface, at least one side and an engagement structure at the at least one side, the top surface of the second module being coplanar with the top surface of the first module;

providing a third module having a central vertical axis aligned substantially with the central vertical axis of said first module, said third module having a top surface, at least one side and an engagement structure at the at least one side, the top surface of the third module being coplanar with the top surface of the first and second modules; and,

providing an elongated plate having a first, second and third engagement structure;

removably engaging the first engagement structure with the engagement structure of said first module;

removably engaging the second engagement structure with the engagement structure of said second module; and

removably engaging the third engagement structure with the engagement structure of said third module.

20. The method of claim 19, wherein the first, second and third modules each have a body formed of an insulative material.

21. The method of claim 19, wherein said board comprises a printed circuit board.

22. The method of claim 19, wherein said engagement structures of said first, second and third modules each comprise a projection and said first, second and third engagement structures of said elongated plate each comprise a slot.

23. The method of claim 19, wherein each of said first, second and third modules are substantially rectangular or square in shape.

24. A connector assembly comprising:

a first module having a top surface, a first side with an engagement structure and a second side;

a second module having a top surface, a first side with an engagement structure and a second side, wherein the second side of said second module is substantially aligned with the second side of said first module along a first plane, and the top surface of said first module is coplanar with the top surface of said second module; and,

an elongated plate having a first engagement structure removably engaging the engagement structure of said first module and a second engagement structure removably engaging the engagement structure of said second module to thereby removably engage said first module and said second module.

25. The connector assembly of claim 24, wherein the second side of said first and second modules does not have any engagement structure.

26. The connector assembly of claim 24, wherein the second side of said first module faces the second side of said second module.

27. The connector assembly of claim 24, wherein the first side of said first module is substantially perpendicular to the second side of said first module, the first side of said second module is substantially perpendicular to the second side of said second module, the first side of said first module is substantially parallel to the first side of said second module, and the second side of said first module is substantially parallel to the second side of said second module.

28. The connector assembly of claim 24, wherein said first and second modules each have a top that receives at least one connector.

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